CLAIMS

What is claimed is:

1. A method for insulating at least one aperture formed through a substrate, comprising:
introducing a quantity of unconsolidated dielectric material into the at least one aperture; and
selectively consolidating unconsolidated dielectric material located adjacent to a periphery of the at least one aperture to form an insulative coating on surfaces of the at least one aperture.

2. The method of claim 1, wherein said introducing comprises introducing a quantity of unconsolidated UV-curable dielectric material into the at least one aperture.

3. The method of claim 2, wherein said selectively consolidating comprises exposing portions of said unconsolidated UV-curable dielectric material to UV radiation in the form of a laser beam.

4. The method of claim 1, wherein said introducing comprises dispensing said quantity of unconsolidated dielectric material into the at least one aperture.

5. The method of claim 1, wherein said introducing comprises lowering a level of the substrate relative to a level of a volume of said unconsolidated dielectric material.

6. The method of claim 1, wherein said selectively consolidating comprises directing an energy beam onto selected regions of said quantity of unconsolidated dielectric material.

7. The method of claim 1, further comprising:
repeating said introducing and said selectively consolidating at least once to form another layer of said insulative coating.

8. The method of claim 1, further comprising:
removing unconsolidated dielectric material remaining within the at least one aperture.

9. The method of claim 8, wherein, upon said removing, a via hole that extends through said insulative coating is exposed.

10. A method for forming electrically conductive vias through a substrate, comprising:
forming at least one precursor hole through the substrate;
introducing unconsolidated dielectric material into said at least one precursor hole; and
selectively consolidating portions of said unconsolidated dielectric material at locations adjacent to a periphery of said at least one precursor hole to form a layer of an insulative coating on surfaces of said at least one precursor hole.

11. The method of claim 10, wherein said forming comprises forming said at least one precursor hole to have one of a substantially cylindrical shape, a substantially frustoconical shape, an hourglass shape, and a bulging center.

12. The method of claim 10, wherein said forming includes drilling through the substrate.

13. The method of claim 12, wherein said forming further includes trepanning the substrate.

14. The method of claim 10, wherein said introducing comprises introducing an unconsolidated UV-curable dielectric material into said at least one precursor hole.

15. The method of claim 14, wherein said selectively consolidating comprises exposing portions of said UV-curable dielectric material to UV radiation in the form of a laser beam.

16. The method of claim 10, wherein said introducing comprises dispensing said unconsolidated dielectric material into said at least one precursor hole.

17. The method of claim 10, wherein said introducing comprises lowering a level of the substrate relative to a level of a volume of unconsolidated dielectric material.

18. The method of claim 10, wherein said selectively consolidating comprises directing an energy beam onto said portions of said unconsolidated dielectric material.

19. The method of claim 10, further comprising:
repeating said introducing and said selectively consolidating at least once to form another layer of said insulative coating.

20. The method of claim 10, further comprising:
removing unconsolidated dielectric material remaining within said at least one precursor hole.

21. The method of claim 20, wherein, upon said removing, a via hole that extends through said insulative coating is exposed.

22. The method of claim 21, further comprising:
introducing conductive material into said via hole.

23. The method of claim 22, wherein said introducing conductive material comprises introducing at least one of polysilicon, a metal, a metal alloy, a conductive elastomer, and a conductor-filled elastomer into said via hole.

24. The method of claim 22 wherein said introducing conductive material comprises at least one of physical vapor depositing, chemical vapor depositing, electrolytic plating, electroless plating, and immersion plating.

25. The method of claim 22, wherein said introducing conductive material comprises dispensing said conductive material.

26. A semiconductor device structure, comprising:

a substrate;

at least one aperture extending through said substrate; and

an insulative coating on each surface of said at least one aperture, comprising a plurality of superimposed, contiguous, mutually adhered material layers, and forming a via hole through said substrate.

27. The semiconductor device structure of claim 26, wherein said insulative coating comprises polymer.

28. The semiconductor device structure of claim 27, wherein said polymer comprises a UV-cured polymer.

29. The semiconductor device structure of claim 26, further comprising:

a conductive via within and extending through said via hole.

30. The semiconductor device structure of claim 29, wherein said conductive via comprises at least one of polysilicon, a metal, a metal alloy, a conductive elastomer, and a conductor-filled elastomer.

31. The semiconductor device structure of claim 26, comprising a plurality of apertures extending through said substrate, each aperture of said plurality of apertures being lined with an insulative coating comprising polymer.

32. A system for forming conductive vias through substrates, comprising:
an aperture-forming element configured to form at least one precursor hole in a substrate;
a dielectric material-introducing element configured to introduce unconsolidated dielectric material into said at least one precursor hole; and
a material consolidation element configured to selectively consolidate unconsolidated dielectric material located adjacent to a surface of said at least one precursor hole.

33. The system of claim 32, wherein said aperture-forming element comprises at least one of a router, a mechanical drill, and a laser drill.

34. The system of claim 32, wherein said aperture-forming element is configured to effect a trepanning process.

35. The system of claim 32, wherein said dielectric material-introducing element is configured to dispense said unconsolidated dielectric material into said at least one precursor hole.

36. The system of claim 32, wherein said dielectric material-introducing element comprises a fabrication tank of a stereolithography apparatus.

37. The system of claim 32, wherein said material consolidation element comprises a source of an energy beam.

38. The system of claim 37, wherein said source comprises a laser.

39. The system of claim 38, wherein said laser is configured to generate a UV laser beam.

40. The system of claim 32, further comprising:

an unused material-removal element configured to remove unconsolidated dielectric material from said at least one precursor hole following use of said material consolidation element.

41. The system of claim 32, further comprising:

a conductive material introduction element.

42. The system of claim 41, wherein said conductive material introduction element is configured to dispense conductive material into a via hole that extends through an insulative coating formed by selectively consolidated insulative material.

43. The system of claim 41, wherein said conductive material introduction element comprises at least one of a physical vapor deposition chamber, a chemical vapor deposition chamber, an electrolytic plating bath, and an electroless or immersion plating bath.

44. A surface level control system for a stereolithographic fabrication tank, comprising:

at least one aperture defined through a side wall of the stereolithographic fabrication tank; and

at least one receptacle for receiving unconsolidated material from the stereolithographic fabrication tank in communication with said at least one aperture.

45. The surface level control system of claim 44, wherein said at least one aperture is configured and located so as to remove a displaced volume of said unconsolidated material from the stereolithographic fabrication tank.

46. The surface level control system of claim 44, wherein a bottom edge of said at least one aperture is located at an elevation on said side wall which is at about a desired location of a surface level of said unconsolidated material within the stereolithographic fabrication tank.

47. The surface level control system of claim 44, further comprising:

a material recycling element in communication with said at least one receptacle and the stereolithographic fabrication tank and configured to transport material within said at least one receptacle into the stereolithographic fabrication tank.